APPENDIX B.

CHRONOLOGICAL SUMMARIES OF

CONFIRMATION TEST
(November 27 – December 2, 2006)

AND

EXTENDED DURATION TESTS
(December 4 – 10, 2006 and May 14 – 19, 2007)

CHRONOLOGICAL SUMMARIES OF CONFIRMATION TEST AND EXTENDED DURATION TESTS

This appendix describes the chronological operation of the Cement-Lock demo plant during the Confirmation Test with sediment dredged from the Stratus Petroleum site in Upper Newark Bay from November 27 – December 2, 2006 and the Extended Duration Tests with sediment dredged from the Passaic River (Harrison Reach) from December 4 – 10, 2006 and May 14 – 19, 2007.

Chronological Discussion of Confirmation Test Operations

In preparation for Confirmation Test operations, a 10,000-lb capacity scale was ordered and delivered from Industrial Scales (Linden, NJ). The scale was capable of weighing a skidsteer with and without a bucket-full of sediment-modifier mixture. Using the scale, we were able to monitor how much sediment/modifier mixture was being fed to the conveyor belt system and thus to the rotary kiln system.

In preparation for the EPA SITE program arrival at the plant, a second trailer was ordered for the EPA SITE staff, operating labor, supplies, and preparation area.

Nine tons of pulverized (-100 mesh) lime (CaO) were ordered and delivered from Graymont (PA) and pneumatically loaded into the lime hopper (T-302). The lime was to be used for air pollution control during operations with both Stratus Petroleum sediment and Passaic River sediment (in the Extended Duration Test).

The emergency generator (EmGen) was delivered by Foley Power Systems on November 13, 2006. SM Electric connected the EmGen to the emergency grid by running appropriate cables from the EmGen to the MCC. The EmGen was tested for proper function.

ECH rented a NOx meter (Testo 350XL Combustion Efficiency kit) from CleanAir Rentals (Palatine, IL) for monitoring NOx in the flue gas as required by the Environmental Improvement Pilot Test permit. NOx samples were taken periodically during the Confirmation Test and are discussed later in this report section.

GTI arranged for Trace Environmental Systems to come to the demo plant site and evaluate the condition of the Continuous Emissions Monitoring System (CEMS). Calibration gases for the

CEMS were ordered and delivered from Spectra Gases (Branchburg, NJ). Calibration gases include 160 ppm CO in nitrogen, 2400 ppm CO in nitrogen, and nitrogen zero gas.

The natural gas supply to the demo plant was restored by the local utility PSE&G on November 1, 2006. According to PSE&G, the residual gas pressure in the main was 12 psig, indicating that the natural gas supply piping had not lost any significant pressure since the previous plant operation in March 2005.

RPMS operated the five major equipment blowers from the HMI (human machine interface, i.e., the computer) and found that they were working satisfactorily. Scales Compressor Company visited the plant and checked out and evaluated the air compressor and the natural gas booster pump. Scales conducted maintenance repairs on both units as required.

The bag house reverse pulse cleaning system was checked out. Means of reducing the severity of the pressure drop fluctuations during the reverse pulsing activity were implemented during the Confirmation Test.

Modifier Feeder Calibration: For the Extended Duration Test, the Passaic River sediment needed to be blended with modifiers prior to feeding. The Stratus Petroleum site sediment had been mixed with modifiers during previous campaigns. In preparation for feeding the Passaic River sediment, both limestone and alumina feeders were recalibrated. The limestone feeder was calibrated successfully. However, the results of the alumina feeder calibration were inconsistent. While troubleshooting the alumina feeder, the cover to the small belt conveyor (C-103) was opened and it was observed that the discharge chute from the hopper (T-104) had been installed backwards severely restricting flow. After, the necessary corrections were made and the feeder was reassembled, the alumina feeder was successfully calibrated.

Plant Start-Up: We started up the demo plant equipment and readied it for operation on November 27, 2006 (Monday). Mr. Louis Ringger, CEntry Constructors and Engineers, was on-site during the Confirmation Test as a consultant.

Initially, we had difficulty lighting the primary burner to the rotary kiln. It would spontaneously shut down after reaching a temperature of about 450° to 475°F. One of the RPMS staff suggested that electrical connections in the primary burner control panel may have become

corroded and needed cleaning. After the connections were cleaned, the burner was restarted at about 9:30 a.m. on November 28, 2006 (Tuesday). The system was heated at the prescribed rate of 100°F per hour to about 1800°F and held at that temperature overnight.

The next morning November 29, 2006 (Wednesday), we began heating the system to the target temperature of 2400°F. After a few hours when the rotary kiln temperature reached about 2200°F, we noticed slag dripping on the west wall opposite the kiln nose. The source of this slag was apparently fly slag from the March 2005 non-slagging campaign that had accumulated in the Secondary Combustion Chamber. The fly slag was melting and flowing to the drop-out box. As time progressed, this slag accumulation grew into a "pancake" (like a toadstool on a tree) about 1 foot in diameter and about 1 foot above the water level in the granulator. We monitored the growth of this pancake closely.

At about noon, the temperature in the rotary kiln reached 2400°F and we began feeding the sediment-modifier mixture to the system via the skidsteer bucket. To start, we fed one bucket of sediment-modifier mixture (about 1000 lb) per hour. Also during this time, the damper control on the I.D. (induced draft) fan jammed and needed to be freed up, which was done.

About 2,000 pounds of sediment-modifier mixture were fed to the system and some chunks of slag material came out of the granulator. Some granules of Ecomelt were also produced. The slag pancake on the west wall continued to grow in width and height and threatened the continuation of the test. It extended from the west wall eastward almost connecting with the east wall under the kiln becoming what is commonly known as a "devil's tongue." In the north-south direction, it covered about 1/3 of the drop-out box opening. At about 4:15 p.m., GTI staff went up to the north side view port to photograph the slag accretion. However, in the interim, the pancake of slag had detached itself from the west wall and dropped into the granulator. From the upper view port the drop-out box discharge was clear. The control room was alerted that the granulator would probably jam due to this large mass of slag, which it subsequently did. Efforts to clear the jam at that time were unsuccessful.

A short time earlier (about 3:30 p.m.), the cylinder packing around the V-Ram feeder piston had forced its way out of the cylindrical constrains and the V-Ram piston became jammed. We contacted V-Ram Technical Support immediately to discuss options. They sent replacement

packing and parts by overnight courier and said that it may be necessary to modify the ram head to loosen up the equipment tolerances.

Overnight we cooled the kiln to an "idling" temperature of 1800°F to conserve fuel. The jam in the granulator was cleared by the night shift operators. In the morning (November 30, 2006, Thursday), the drag conveyor was operated in forward and reverse direction to get the chain moving. The broken chunks of slag were readily removed and the granulator was put back into operation at about 7:30 a.m.

That day, the V-Ram field technician said that we needed to get some measurements on the main body of the ram and the two floating wedges. V-Ram technical staff were concerned that there was not enough clearance for these parts to move freely. We opened the cover on the V-Ram feeder and accessed the ram, took measurements, and relayed them to V-Ram. V-Ram said that the main body of the ram needed more clearance and that 0.1 inch of steel needed to be removed from the top edge of the ram. The floating wedges also needed to be machined down about 1/32 inch. V-Ram also said that the grooves in the main body were not appropriate for our application and should be filled with weldment. As a result, we removed the ram from the piston shaft and sent it to a local machine shop for machining as above (V-Ram paid for the machining). Also, the packing gland parts V-Ram sent by UPS arrived on site.

We reduced the temperature of the system to 1700°F and maintained it overnight pending receipt of the machined parts.

The next morning (December 1, 2006, Friday) we heated the system back up to operating temperature of 2450°F. The V-Ram piston was reassembled with the machined ram and put back into operation. At about 1:45 pm, we began feeding the sediment-modifier to the system via 5-gallon buckets to test the V-Ram, which operated well. We then fed the system from the skidsteer bucket from the sediment storage area. The nominal feed rate was 2 buckets (about 2,000 lb) per hour of sediment-modifier mixture. Sediment-modifier mixture was fed consistently all afternoon. Ecomelt was generated and we deposited two 1-yd^3 hoppers full of Ecomelt (Figure B-1) and other slag material in a lined pile in the western part of the demo plant site. At that time, we did not have direct means of weighing the Ecomelt that had been collected.

Figure B-1. Ecomelt Product Accumulating in the Skip Hopper

In the meantime, another devil's tongue was forming on the west wall of the drop-out box. It should be mentioned that some slag remained on the west wall after the "devil's tongue" dropped off on Wednesday evening. As time progressed, the devil's tongue grew and covered much of the space between the kiln nose and the west wall. Anticipating that the devil's tongue would again drop off the west wall, we stopped sediment feeding at about 6:00 p.m. to allow material in the kiln to exit to minimize the load on the granulator drag conveyor.

At 8:15 p.m., the slag mass detached itself from the west wall and fell into the granulator. There was a sharp drop in rotary kiln temperature (a drop of about 90°F) and a spike in the system pressure due to the flash of steam generated. As expected, the granulator drag chain jammed due to the slag chunk. We attempted to clear the jam until about 12:00 midnight when we decided that the system needed to be cooled to remove the slag. Cooling was initiated at that point at the prescribed rate of 100°F/hour.

Overall, the December 1, 2006 campaign achieved much improved and consistent feeding via the V-Ram feeder and significant production of Ecomelt. This test was more successful than any other previous slagging campaign in the demo plant. The temperature of the Ecomelt Generator

ranged from 2400° to 2580°F and the temperature of the Secondary Combustion Chamber ranged from 2220° to 2500°F. The major operating conditions of the Confirmation Test are summarized in Table B-1. The time-temperature history of the Confirmation Test with Stratus Petroleum sediment-modifier mixture is presented in Figure B-2.

Natural gas consumption averaged 18.5 to 19 million Btu per hour with a maximum of 21.5 million Btu per hour. When the system was "idling" overnight (no feeding) at 1700° or 1800°F, the natural gas consumption was about 10 or 11 million Btu per hour, respectively.

About 5.1 tons of sediment-modifier mixture were fed to the system, which yielded an estimated 3.8 tons of Ecomelt. The natural gas consumption recorded during the Confirmation Test is presented in Figure B-3. The Ecomelt Generator temperature is x10 to facilitate comparison.

The quantities of sediment-modifier mixture fed to the system during the several days of the Confirmation Test are included in Table B-2.

Table B-1. Summary of Operating Conditions for Cement-Lock Demo Plant Confirmation Test with Stratus Petroleum Sediment-Modifier Mixture

Test No.	**7**
Test Dates	11/27 – 12/2/06
Ecomelt Generator (rotary kiln)	
Temperature, °F	2200 – 2580
Pressure, inches (water gauge)	-0.3
Kiln Speed, rpm	0.25 – 0.3
Solids Residence Time, min.	129 - 107
Secondary Combustion Chamber	
SCC Burner	Low fire
Temperature, °F	2220 – 2500
Process Temperatures, °F	
Granulator	195
Quencher Outlet, average (min – max)	325 (289 – 375)
Bag House Outlet, average (min – max)	295 (275 – 314)
Activated Carbon Bed Outlet, average (min – max)	245 (225 – 268)
Stack Gas, average (min – max)	280 (257 – 296)
Flue Gas Components	
O_2, vol % (dry basis)	5.0 – 6.86
NOx, ppm (dry basis)	102 – 171

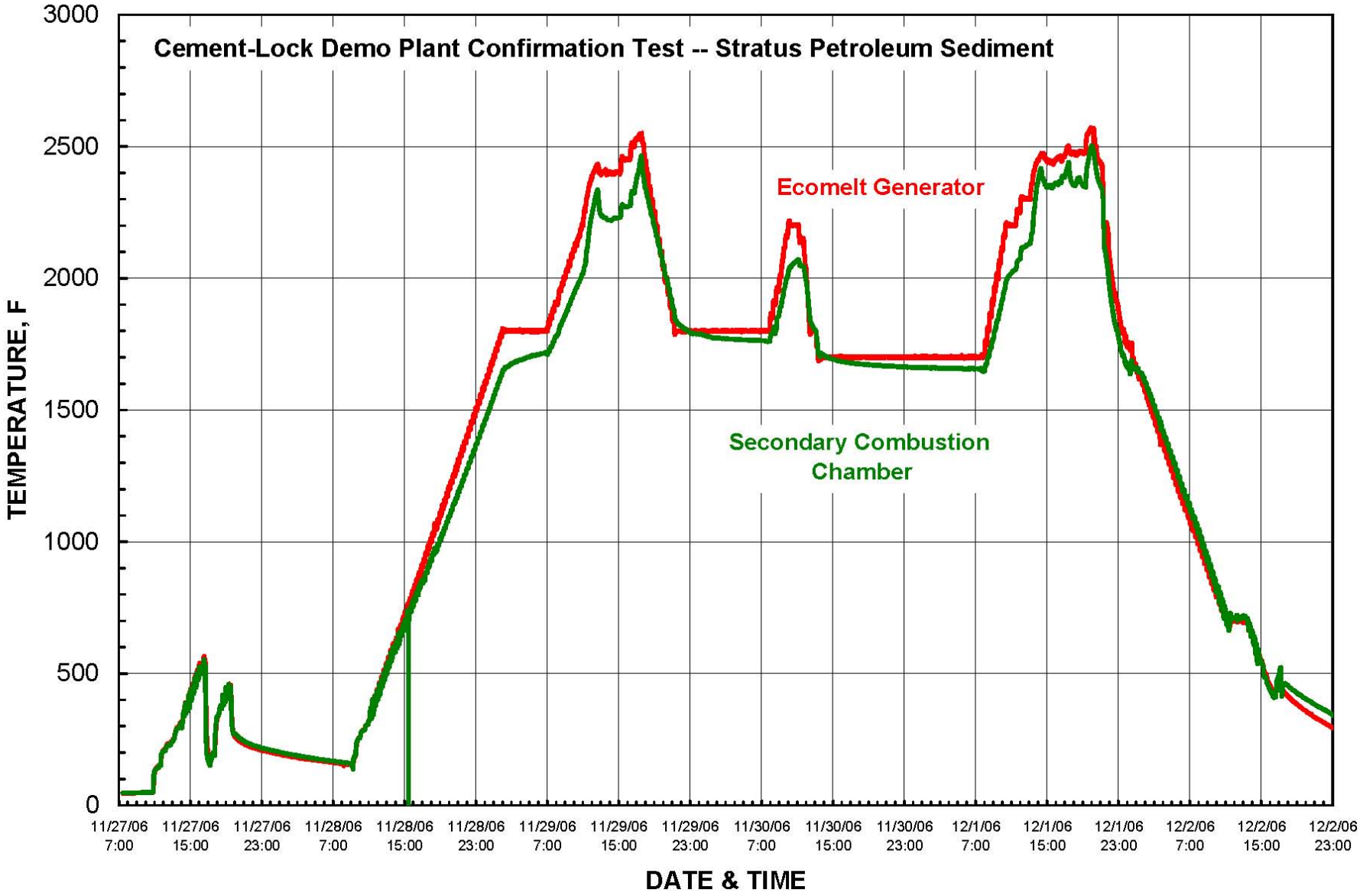


Figure B-2. Time-Temperature History of the Confirmation Test with Sediment Dredged from the Stratus Petroleum Site (sediment-modifier mixture)

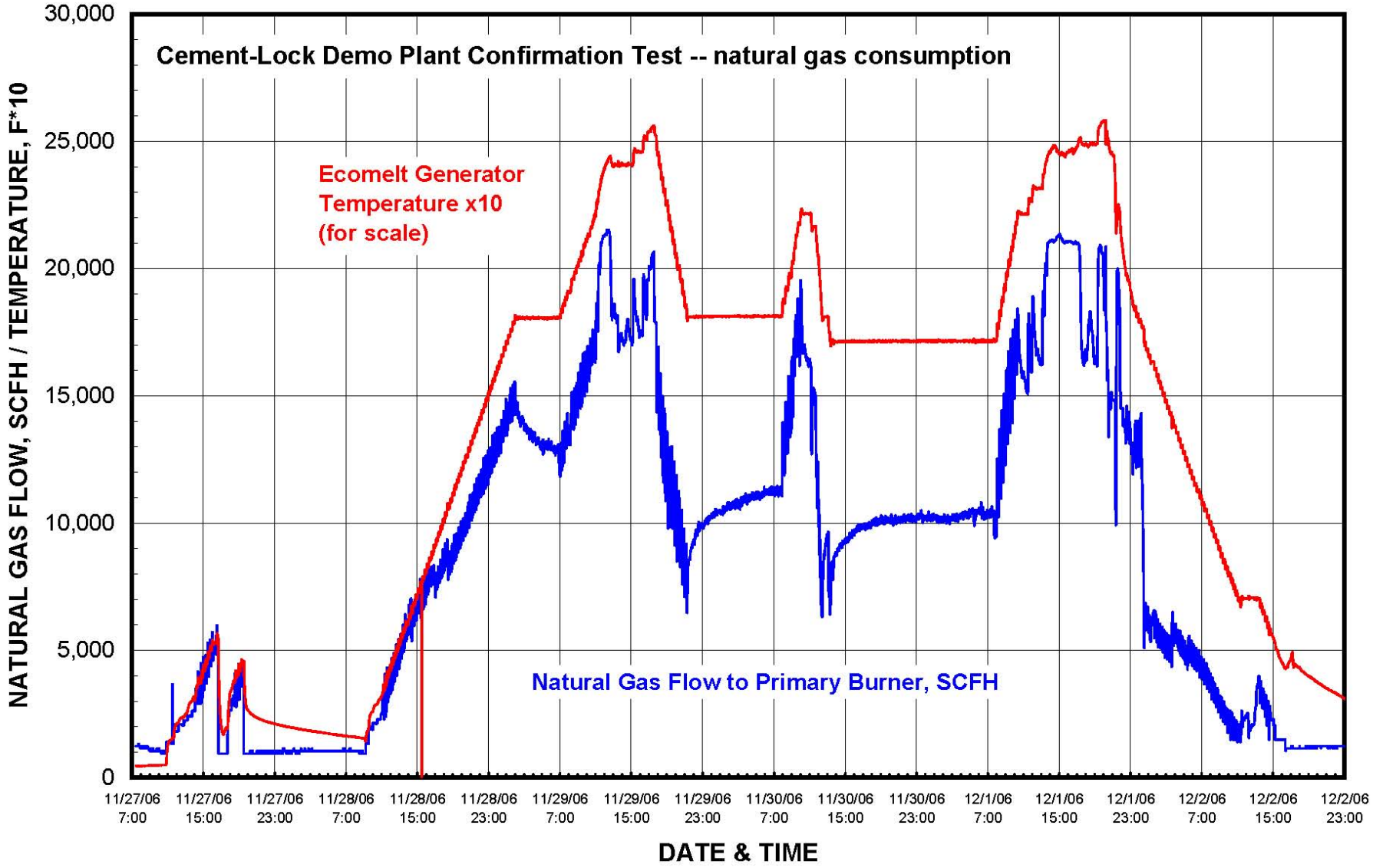


Figure B-3. Natural Gas Consumption During the Confirmation Test (November 27 – December 2, 2006)

Table B-2. Chronology of Sediment-Modifier Mixture Feeding Episodes During the Cement-Lock Confirmation Test (November 29 – December 1, 2006)

STRATUS PETROLEUM SEDIMENT								Cumulative		
		-- Feeding Time --		---- Weights, lb ----				- Sed/mod Fed -		Daily
Batch No.	Date / Time	Start	End	Gross	Tare	Net	Tons	Total, lb	Tons	
1	11/29/06 1:30 PM	1:30 PM	2:15 PM	--	--	1,156	0.58	1,156	0.58	
2	11/29/06 2:15 PM	2:15 PM	3:00 PM	--	--	958	0.48	2,114	1.06	
3	11/29/06 3:00 PM	3:00 PM	3:30 PM	--	--	481	0.24	2,595	1.30	1.30
		3:30 PM	V-Ram jammed, stopped feeding							
1	12/1/06 1:45 PM	1:45 PM	2:15 PM	6 5-gal pails		240	0.12	2,835	1.42	
2	12/1/06 2:15 PM	2:15 PM	2:56 PM	9,054	7,888	1,166	0.58	4,001	2.00	
3	12/1/06 3:15 PM	3:15 PM	3:40 PM	8,672	7,932	740	0.37	4,741	2.37	
4	12/1/06 3:46 PM			8,810	7,846	964	0.48	5,705	2.85	
5	12/1/06 4:17 PM	4:17 PM	4:45 PM	8,816	7,814	1,002	0.50	6,707	3.35	
6	12/1/06 4:45 PM	4:45 PM	5:30 PM	8,166	7,460	706	0.35	7,413	3.71	
7	12/1/06 5:30 PM	5:30 PM	5:41 PM	8,690	7,810	880	0.44	8,293	4.15	
8	12/1/06 6:11 PM	6:11 PM	6:13 PM	9,194	7,846	1,348	0.67	9,641	4.82	
9	12/1/06 6:25 PM	6:25 PM	--	9,598	8,498	550 (½ load)	0.28	10,191	5.10	3.80
		Feeding stopped in anticipation of large slag chunk dropping								
		8:15 PM	Granulator jammed – large slag chunk dropped							**5.10**
		Total Stratus Petroleum Sediment-Modifier Mixture fed						5.10 tons		
		Average Sediment-Modifier Feed Rate						1,904.3 lb/hr (0.952 ton/hr)		
		Average Ecomelt Rate						1,241.6 lb/hr (0.621 ton/hr)		

As mentioned above, the slag jammed the granulator drag conveyor making it necessary to cool the system so that it could be cleared. It would take a day to cool the system, at least several hours to clear the jam, and a day to heat the system up to operating temperature. At the same time, the EPA SITE stack and environmental sampling teams had mobilized to the site to take samples during the Extended Duration Test with sediment dredged from the Passaic River.

On December 2, 2006 (Saturday) at about 5:00 p.m., the kiln had cooled sufficiently so that we could open the access hatchway on the north side of the drop-out box. We observed the slag mass to be irregularly shaped about 2½ ft long, 1½ ft wide and 2 ft tall. It was resting on the upper drag conveyor slats. Due to safety concerns we only reached into the hatchway with a sledge hammer to see how brittle/friable the mass was. After a few impacts with the hammer, a few large chunks (½ to 1 foot in size) were fractured and removed from the mass. The slag was observed to be porous and relatively low in density.

The Extended Duration Test was to follow immediately after the Confirmation Test. Unfortunately, the stack and environmental sampling teams could not accommodate the delay. They needed to complete their work and move on to another assignment, which could not be postponed. Therefore, it was agreed by the sponsors, ECH and GTI to discontinue the Confirmation Test (with Stratus Petroleum sediment) and begin the Extended Duration Test (with Passaic River sediment). This was done so that the EPA SITE stack and environmental sampling teams could collect their samples.

NOx Analysis: Nitrogen oxides (NOx) analysis of the flue gases in the stack during the Confirmation Test are summarized in Table B-3. The NOx analysis ranged from 102 to 171 ppm (dry basis) during the Confirmation Test. The corresponding oxygen concentrations were 5.00 and 6.86 mole percent, respectively. Sediment was fed to the system on November 29 and December 1, 2006. A NOx sample was taken on November 30, 2006 but no sediment was fed on that day.

NOx can be formed from nitrogen in sediment (nitrogen content of Stratus Petroleum sediment was about 0.33 wt %), from nitrogen in the natural gas (<3 volume %), and from nitrogen in the air (20.9 mol %). NOx formation in combustion systems increases with increasing temperature due to oxidation of nitrogen in the atmosphere. Therefore, it would be beneficial to operate a

Cement-Lock plant (either demo or commercial) at the lowest practical temperature to minimize NOx formation without jeopardizing technology performance.

The design of a commercial-scale (500,000 yd^3 of sediment per year capacity) Cement-Lock facility will include Selective Catalytic NOx Reduction (SCR) equipment to reduce the emission of NOx to the maximum practical extent as well as to comply with local permit requirements. Low-NOx burners in the system will also be included in the design.

Table B-3. Summary of NOx Measurements Taken During the Confirmation

Date and time	O_2 content mol %	NO Content ppm	NO_2 Content ppm	NOx Content ppm (NO + NO_2)
11/29/06, 10:32 am	7.48	118.6	0.0	118.6
11/29/06, 11:35 am	4.65	91.3	0.2	91.5
11/29/06, 1:42 pm	6.86	170.7	0.6	171.3
11/29/06, 3:11 pm	6.92	154.8	0.2	155.1
11/29/06, 3:13 pm	5.00	102.1	0.0	102.1
11/30/06, 9:35 am	8.05	110.5	0.0	110.5
12/1/06, 2:44 pm	2.37	35.5	0.0	35.5

Chronological Discussion of Extended Duration Operations

The Extended Duration Test was initiated on December 4, 2006 (Monday). On that day, the RPMS operating crew began breaking up the remaining slag mass and chipped slag from the rotary kiln nose as well as the west and south walls as needed. Essentially no slag was observed on the south wall (a concerned had been raised about slag dripping on the south wall due to the small clearance from the nose).

This report section describes the operation of the Cement-Lock demo plant for the Extended Duration Test with sediment dredged from the Harrison Reach of the Passaic River. As per agreement between NJ-DOT/OMR and EPA Region 2, GTI, and ECH, the next test was to be conducted with Passaic River sediment instead of Stratus Petroleum sediment. The initial Passaic River sediment feed rate was planned to be 2,000 pounds per hour (modifiers were to be fed separately from the modifier hoppers). The following discussion includes the Extended Duration Tests conducted in December 2006 and May 2007.

Extended Duration Test – December 2006: The stack sampling crew (AirNova, Pennsauken, NJ), Tetra Tech EMI (Tetra Tech, Cincinnati, OH), and a representative from the EPA SITE

Program arrived at the demo plant site on December 4, 2006 and began setting up their equipment including data acquisition trailer. AirNova had conducted stack sampling for Brookhaven National Laboratory during the GTI pilot test conducted with Newtown Creek sediment at Hazen Research (Golden, CO) in 1996.

To accommodate the 8 to 12 additional staff from AirNova, Tetra Tech, and the EPA SITE program, a second trailer was rented and delivered to the site. Sanitary tanks were also ordered and installed on the two trailers (instead of one portable toilet). Electric power was connected to the AirNova data acquisition trailer, the stack, and the activated carbon bed inlet locations.

For this test, the kiln operating temperature was reduced from 2475° to 2400°F to reduce the kiln flue gas velocity and minimize slag droplet carryover to the west wall. Reducing the temperature will increase slag viscosity so the combined effects needed to be monitored closely. The excess air was also going to be reduced while maintaining permitted CO and O_2 levels.

On December 4, 2006 (Monday), after executing a confined space entry permit, operating personnel broke up the remaining slag mass and chipped excess slag from the kiln nose as well as the west and south walls. Very little slag was observed on the south wall.

After the system was sealed and readied for operation, some difficulty was again experienced igniting the primary burner to the rotary kiln. It was determined that one of the mechanical switches inside the Maxon switch was not making contact. This was rectified and the primary burner was ignited.

On Wednesday, Passaic River sediment and modifiers were fed at a rate of 1,400 pounds per hour beginning at about 8:20 a.m. (the sediment feed rate was 1,000 lb/hr; the modifier feed rate was 400 lb/hr). At 10:10 a.m., there was a brief power outage caused by the nose cooling blower that shut the plant down. The problem was resolved and by 11:45 a.m. the system was reheated to operating temperature (the kiln temperature had dropped during the power outage). At 1:00 p.m. the system was at the target temperature of 2400°F and feeding was resumed. During the test, the Secondary Combustion Chamber temperature ranged from 2300° to 2350°F. By 3:30 p.m. enough Ecomelt had been generated to fill the skip hopper (1 yd^3). The skip hopper was

transported to the western section of the plant site and the first batch of Ecomelt from Passaic River sediment was placed on a tarp.

The EPA SITE stack and environmental sampling teams took samples during the steady operating period.

During the rest of the day, a devil's tongue was observed forming on the west wall opposite the kiln nose. At about 8:00 p.m. the devil's tongue fell off and jammed the granulator. By running the granulator forward and backward the jam was cleared thereby avoiding a plant shutdown. A photo of the devil's tongue discharged from the granulator is shown in Figure B-4. It was about two feet long and about 1½ feet wide.

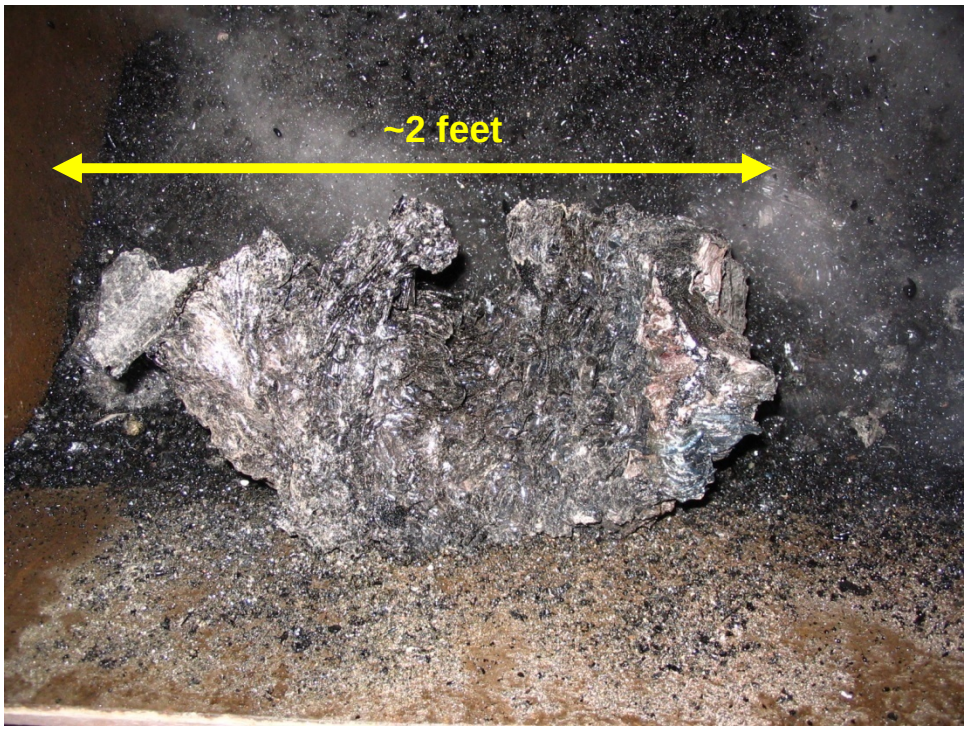


Figure B-4. Slag Chunk Cleared from Granulator and Discharged (December 6, 2006)

During Wednesday, a total of about 6 tons of Passaic River sediment was fed to the system. Limestone (Modifier 1) was fed to the pug mill for mixing with sediment at a rate of about 400 pounds per hour.

As per the campaign operating protocol, for the overnight shift, feeding was halted and the kiln temperature was maintained at 2400°F.

On Thursday (December 7, 2006), feeding of Passaic River sediment and modifiers was initiated at 7:40 a.m. at a rate of about 1,400 pounds per hour. The EPA SITE stack and environmental sampling teams took samples during the steady operating period.

At one point, the kiln temperature was increased to 2550°F in an effort to dislodge an accretion of slag. Some large chunks of slag were cleared and discharged from the granulator, but the larger fraction of the slag remained. The temperature was then reduced to 2450°F.

During Thursday, about 7 tons of Passaic River sediment were fed to the system. As before, limestone (Modifier 1) was fed to the pug mill for mixing with sediment at a rate of about 400 pounds per hour. This was the most consistent sediment feeding episode to date.

For the overnight shift, feeding was again halted and the kiln temperature was maintained at 2400°F. At about 11:00 p.m. the primary burner experienced a flameout and, after a fairly short time, the kiln temperature dropped to about 1300°F. At first, it was thought that the Maxon switch had again malfunctioned; however, troubleshooting the Maxon switch did not resolve the issue. Finally, after repeated attempts, the primary burner was ignited. The kiln temperature was reheated to the target temperature of 2400°F by about 7:00 a.m. (December 8, 2006).

Overnight, the ambient temperature fell to below freezing and by morning, sediment in the pug mill and the V-Ram feeder had frozen solid. It took until past noon to clear the frozen equipment. Because of this delay in getting underway and resuming sediment feeding, the EPA SITE stack and environmental sampling teams were not able to take samples in a timely manner and withdrew from the site.

Feeding sediment to the system was resumed at about 2:00 p.m. at a rate of about 1,000 pound per hour plus modifiers. During this feeding session, however, slag was observed to begin sticking to the south wall. It was posited that slag already in the kiln had cooled sufficiently during the overnight flameout episode to stick to the south wall. A shelf built up on the west wall and from the south wall as shown in the photo (Figure B-5). The two slag accumulations

joined up during the day and as more sediment was fed, the effective cross-sectional area of the drop-out box continued to diminish.

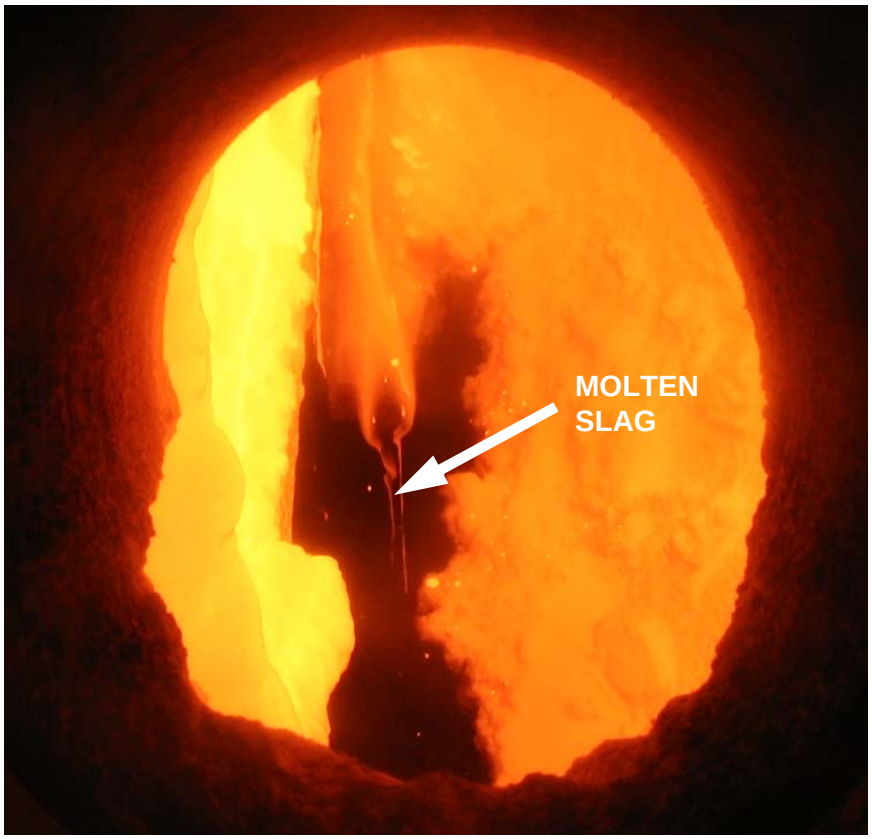


Figure B-5. View from Above Drop-Out Box – Molten Slag Dripping from South Wall into the Granulator (kiln nose left, west wall right)

Fluorspar (CaF_2 – a flux) was added to the kiln in an attempt to make the slag more fluid to dislodge the blockage, but with no effect. At about 9:30 p.m. it was decided to shut the plant down. Later on Saturday (December 9, 2006) the kiln was cool enough to allow the access hatchway in the drop-out box to be opened. Looking south the photo (Figure B-6) shows the well-formed devil's tongue almost in contact with the kiln nose. Note behind and below the devil's tongue is a massive black accretion of slag adhering to the south wall.

The temperature of the Ecomelt Generator ranged from 2300° to 2650°F and the temperature of the Secondary Combustion Chamber ranged from 2245° to 2530°F. The major operating conditions of the Extended Duration Test are summarized in Table B-4. The time-temperature history of the Extended Duration Test with Passaic River sediment-modifier mixture is presented in Figure B-7.

Natural gas consumption averaged 16 to 17 million Btu per hour with a maximum of 27.1 million Btu per hour during initial heat-up. When the system was idled overnight (no feeding) at 1800°F, the natural gas consumption was about 11 million Btu per hour.

Figure B-6. Devil's Tongue Extending from West Wall to Near the Kiln Nose

About 16.5 tons of sediment and an additional 6 check tons of modifiers were fed to the system, which yielded an estimated 12.3 check tons of Ecomelt. The natural gas consumption recorded during the Confirmation Test is presented in Figure B-8. The Ecomelt Generator temperature is x10 to facilitate comparison.

The quantities of sediment-modifier mixture fed to the system during the Extended Duration Test Campaign Test are included in Table B-5.

Summary of December 2006 Campaign: Significant milestones were achieved during the Cement-Lock demo plant campaigns in November and December 2006. The equipment modifications implemented during the project extended the slagging mode operating time

considerably. Sizable quantities of Ecomelt have been generated from both Stratus Petroleum as well as Passaic River sediment. The demo plant has been operated such that the EPA SITE program could conduct stack and environmental sampling – this time under slagging conditions.

Table B-4. Summary of Operating Conditions for Cement-Lock Demo Plant Extended Duration Test (December 4 – 9, 2006)

Test No.	**8**
Test Dates	12/4/06 – 12/9/06
Ecomelt Generator (rotary kiln)	
Temperature, °F	2300 – 2650
Pressure, inches (water gauge)	-0.2
Kiln Speed, rpm	0.25 – 0.3
Solids Residence Time, min.	129 – 107
Secondary Combustion Chamber	
SA Burner	Low fire
Temperature, °F	2245 – 2530
Process Temperatures, °F	
Granulator	195
Quencher Outlet, average (min – max)	325 (267 – 425)
Bag House Outlet, average (min – max)	290 (240 – 318)
Activated Carbon Bed Outlet, average (min – max)	270 (220 – 290)
Stack Gas, average (min – max)	280 (245 – 316)

Overall, the feed system performed quite well. The ALLU screening bucket performed as designed. The conveyor belts effectively conveyed the material from the sediment storage area to the pug mill on the charging deck. The mixer and V-Ram feeder also performed as designed (there was a learning curve associated with operating both of these units with sediment).

The modified demo plant has demonstrated the capability to process sediment at about ½ ton per hour in semi-continuous operation. Slag accumulation in the drop-out box was significantly slowed, but not stopped. Best production achieved to date was 7 tons of sediment per day. Overall, about 5.1 tons of Stratus Petroleum sediment-modifier mixture and about 16.5 tons of Passaic River sediment plus 6 tons of modifiers were processed.

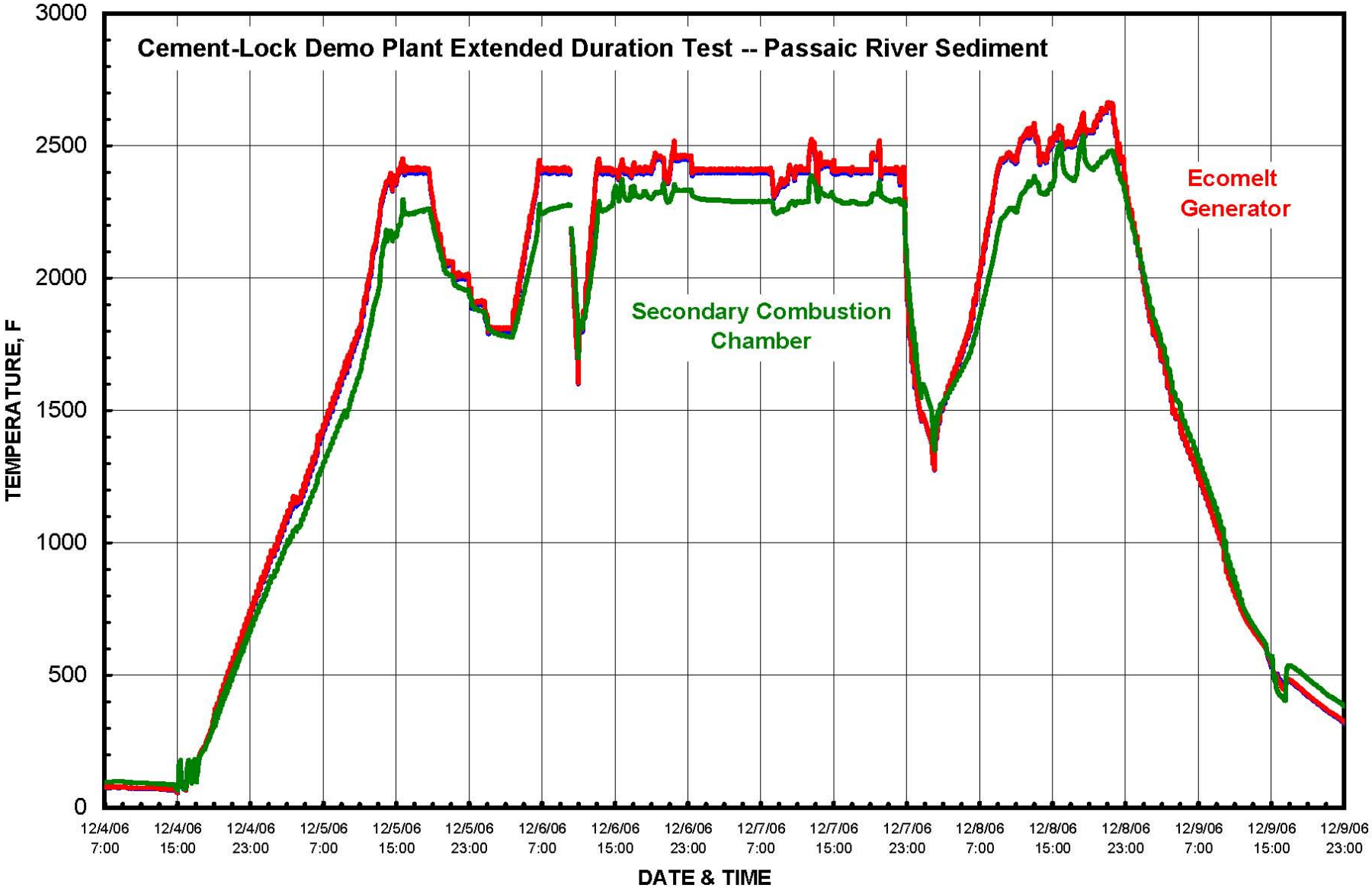


Figure B-7. Time-Temperature History of the Extended Duration Test with Sediment Dredged from the Passaic River (December 4 – 9, 2006)

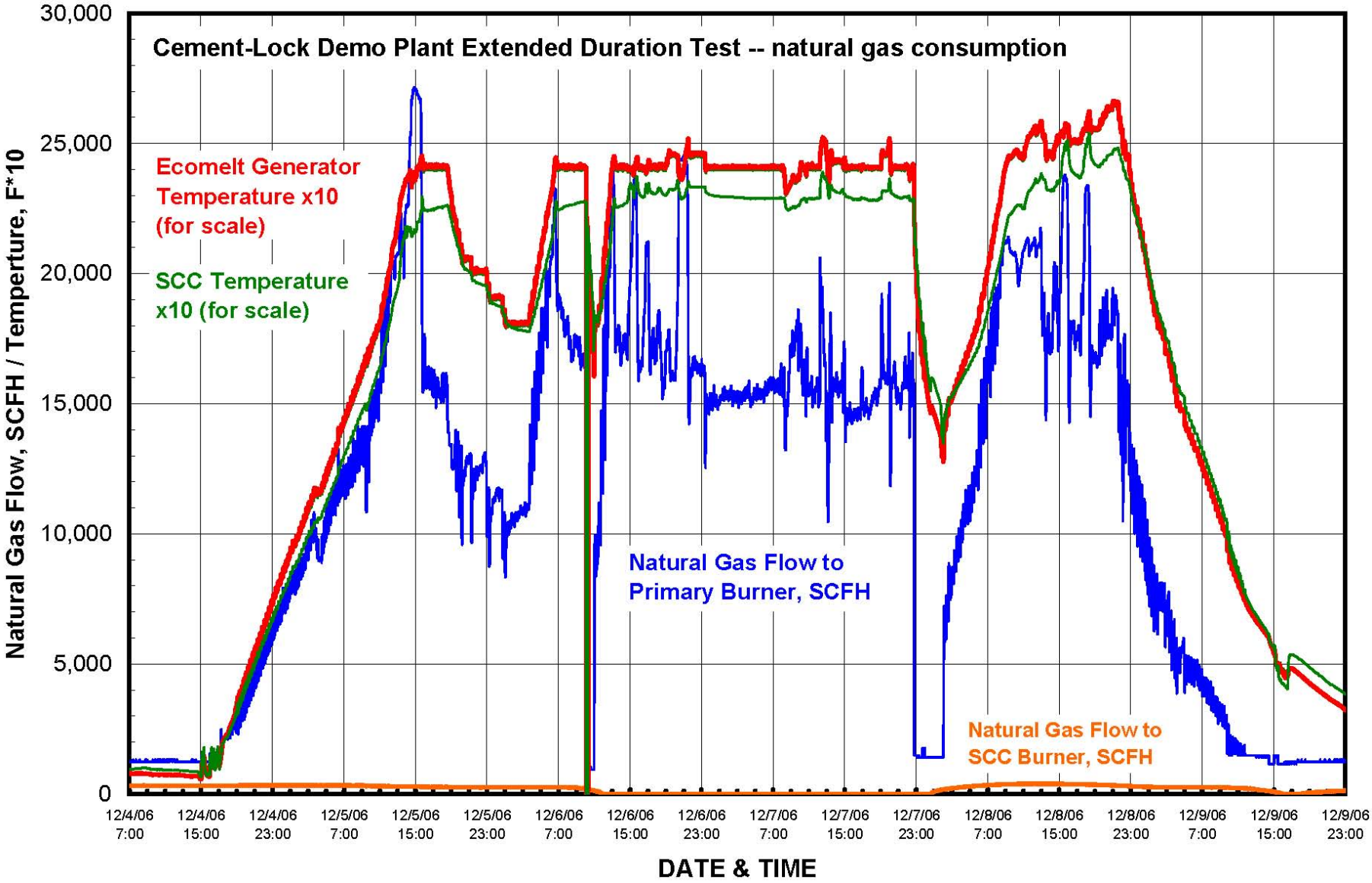


Figure B-8. Natural Gas Consumption During the Extended Duration Test (December 4 – 9, 2006)

Table B-5. Chronology of Sediment Feeding Episodes During the Cement-Lock Extended Duration Test (December 4 – 9, 2006)

PASSAIC RIVER SEDIMENT – MODIFIERS ADDED BY MOD HOPPER									CUMULATIVE		
			--------- Feeding Time ---------		---------- Weights, lb ----------				-- Sediment Fed --		DAILY
Batch No.	Day	Date	Start	End*	Gross	Tare	Net	lb/hr	pounds	tons	tons
1	Wednes	12/06/06	8:22 AM	9:12 AM	8,756	7,558	1,198	1,438	1,198	0.60	
2		12/06/06	1:50 PM	2:35 PM	8,816	7,896	920	1,227	2,118	1.06	
3		12/06/06	2:35 PM	2:50 PM	10,664	9,512	1,152	4,608	3,270	1.64	
4		12/06/06	2:50 PM	3:50 PM	10,654	9,458	1,196	1,196	4,466	2.23	
5		12/06/06	3:50 PM	4:52 PM	10,360	9,496	864	836	5,330	2.67	
6		12/06/06	4:52 PM	5:34 PM	10,750	9,510	1,240	1,771	6,570	3.29	
7		12/06/06	5:34 PM	6:10 PM	10,620	9,514	1,106	1,843	7,676	3.84	
8		12/06/06	6:10 PM	7:00 PM	10,560	9,234	1,326	1,591	9,002	4.50	
9		12/06/06	7:50 PM	8:21 PM	10,648	9,066	1,582	3,062	10,584	5.29	
10		12/06/06	8:21 PM	9:11 PM	10,864	9,508	1,356	1,627	11,940	5.97	5.97
11	Thurs	12/07/06	7:40 AM	8:35 AM	10,514	9,472	1,042	1,137	12,982	6.49	
12		12/07/06	8:35 AM	9:19 AM	10,686	9,550	1,136	1,549	14,118	7.06	
13		12/07/06	9:19 AM	10:06 AM	10,548	9,574	974	1,243	15,092	7.55	
14		12/07/06	10:06 AM	10:42 AM	10,844	9,560	1,284	2,140	16,376	8.19	
15		12/07/06	10:42 AM	11:25 AM	10,454	9,536	918	1,281	17,294	8.65	
16		12/07/06	11:25 AM	12:03 PM	10,480	9,562	918	1,449	18,212	9.11	
17		12/07/06	12:03 PM	12:53 PM	10,688	9,536	1,152	1,382	19,364	9.68	
18		12/07/06	1:13 PM	2:03 PM	10,682	9,532	1,150	1,380	20,514	10.26	
19		12/07/06	2:21 PM	3:12 PM	10,730	9,490	1,240	1,459	21,754	10.88	
20		12/07/06	4:22 PM	5:11 PM	10,512	9,482	1,030	1,261	22,784	11.39	
21		12/07/06	5:11 PM	6:01 PM	10,370	9,488	882	1,058	23,666	11.83	
22		12/07/06	6:30 PM	7:07 PM	10,544	9,506	1,038	1,683	24,704	12.35	
23		12/07/06	7:07 PM	7:57 PM	10,712	9,403	1,309	1,571	26,013	13.01	7.04
24	Friday	12/08/06	2:03 PM	2:55 PM	10,642	9,490	1,152	1,329	27,165	13.58	
25		12/08/06	2:55 PM	3:45 PM	10,844	9,522	1,322	1,586	28,487	14.24	
26		12/08/06	4:05 PM	4:55 PM	10,732	9,228	1,504	1,805	29,991	15.00	
27		12/08/06	5:20 PM	6:08 PM	10,714	9,608	1,106	1,383	31,097	15.55	
28		12/08/06	6:08 PM	6:58 PM	10,870	9,410	1,460	1,752	32,557	16.28	
29		12/08/06	7:03 PM	------ Late night – no modifiers ------			444		33,001	16.50	3.49
			Average Sediment Feed Rate		1,513.1 wet lb/hr		0.757 wet ton/hr			16.50 Total tons	
			Average Ecomelt Rate		1,247.0 lb/hr		0.624 ton/hr				

* End time data estimated from average feeding time and maximum feed interval. Modifiers were fed at a rate of about 400 lb/hour.

Extended Duration Test – May 2007: The May 2007 campaign was inaugurated on April 26, 2007 (Wednesday). RPMS staff attended the mandatory yearly renewal of IMTT Safety Orientation training. That same week, the covered belt conveyors rented from Smalis, Inc. (New Stanton, PA) were delivered to the plant site to be assembled. FMW, the mechanical contractor assembled the conveyor sections, rollers, and belts and lifted each section on its stanchions. A crane was brought on site to put the pieces together. Also, FMW needed to weld on some stiffeners and clips to the conveyors. After the December 2006 campaign was terminated, all of the rental equipment had been returned including the covered belt conveyors. Most, but not all of the conveyor sections were available for the May 2007 campaign. Some mechanical adjustments were necessary on replacement sections.

Also, RPMS observed that some refractory had broken off of the west wall of the drop-out box where the devil's tongues had formed. We asked Duddy Contracting, the company that had installed the refractory, to provide an assessment of the damage. Mr. Kevin Duddy visited the plant and said that some spalling of the refractory had occurred, but due to the relatively short test duration planned (some 120 hours), he said that there was no need to fix or repair the crack at this point. Mr. Duddy also noticed some water leaking through the kiln, probably from a leak in the water cooled feed housing. At that point, we considered this to be a minor inconvenience.

On May 7, 2007 the skidsteer was delivered to the plant. The Emergency Generator (EmGen) and Automatic Transfer Switch (ATS) were also delivered and put into position. Two skip hoppers were delivered to the site for collecting Ecomelt from the quencher granulator drag conveyor. Technicians from Scales Compressor Company were also on site to perform maintenance on the compressor.

The local utility, PSE&G, checked out the natural gas system including two gas meters and confirmed proper operation.

On May 9, 2007 SM Electric staff attended the mandatory IMTT Safety Orientation training and began electrical installation of the belt conveyor system. RPMS brought back on-line the major equipment items including the primary blower, nose cooling blower, I.D. fan, and lime blower.

The ALLU screening bucket was delivered to the site attached to a second skidsteer. On May 11, 2007 representatives from ALLU were on site to instruct the operators on proper operation and maintenance of the bucket.

On May 14, 2007 we lit the primary burner and began heating the system to the target temperature at the prescribed rate of 100°F/hour. We also tested the EmGen for proper function running it for about 5 minutes after which time it was put back into ready mode. The AirNova stack sampling crew arrived at about 9:00 a.m. and began setting up their analytical and control trailer and sampling equipment.

At about 7:45 p.m., the primary burner experienced a flame-out. After some trouble-shooting the Maxon switch, we got the primary burner back online. Because of these issues, we did not feed any sediment to the demo plant on Monday.

Also, the V-Ram feeder was not functioning properly. It would not extend all the way into the discharge as before. We contacted V-Ram for technical support. After some checking, we found that one of the wires on the controller was incorrectly connected. We made the correction and the V-Ram was back in operation about 1:30 p.m. on Tuesday.

After some additional shakedown testing, we began feeding sediment-modifier mixture to the system with the first bucket load at 5:22 p.m. We fed three additional bucket loads of sediment-modifier mixture on Tuesday for a total of about 2 tons - before shift change at 7:00 pm at which time we halted feeding.

On Wednesday, we began feeding at about 10:00 a.m. The stack sampling company also began their sample collection. During the day, we fed a total of about 4.1 tons of sediment-modifier mixture. At about 4:00 p.m. a squall line of storms passed through the region and we halted stack sampling and feeding due to the high winds and electrical storm activity.

Toward the evening on Wednesday the kiln began developing a shelf of slag that extended from the west wall (opposite the rotary kiln) toward the kiln (Figure B-9). As the evening progressed the shelf continued to grow. In an attempt to dislodge the shelf, we incrementally heated the system to 2775° F (close to the high-high limit of 2800°F), but without success.

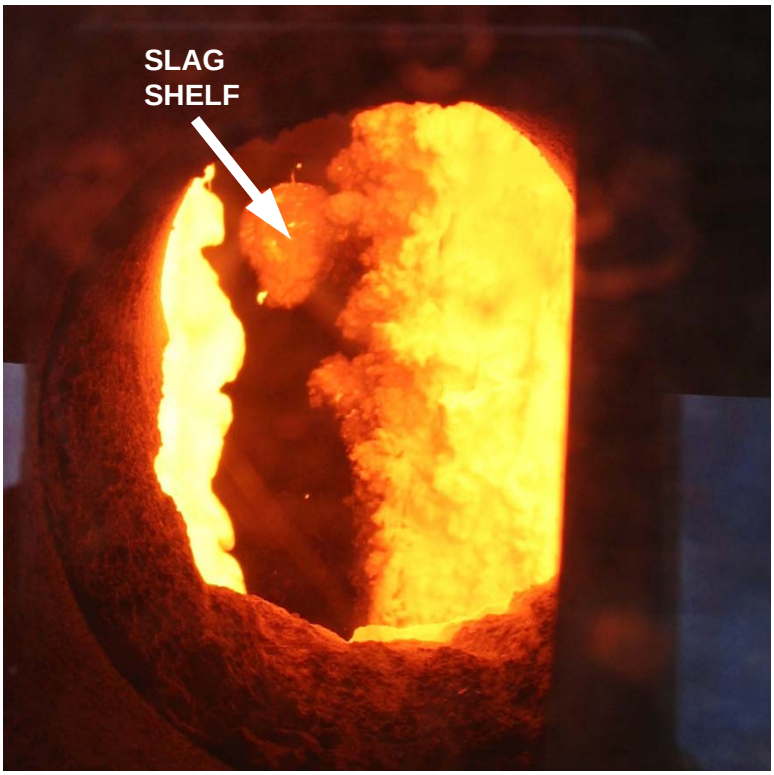


Figure B-9. Slag Shelf Developing on West Wall (right) Extending to Kiln Nose

Further, two sections of the kiln nose (about 12 to 14 inches long) cracked off the nose and fell into the granulator and were discharged. The drop-out box opening was limited to that shown in the photograph (Figure B-10). The vertical line in the left middle of the photo is the interface between the kiln nose (left) and the slag shelf (right). The nose of the kiln is fairly clear of slag. Notice a piece of refractory missing from the nose and a piece of refractory on the shelf.

As of 7:30 am, the plant temperature was being increased from the overnight level of 2400° to 2550°F. After discussing the situation with the Plant Manager, Steve Stetka, we decided to initiate sediment feeding at about 8:30 a.m. so that the air sampling company could take samples. It was understood that no Ecomelt samples could be taken and that slag would accumulate in the drop-out box. Stack sampling was concluded later that day at about 6-7 p.m. The kiln was then cooled to ambient at the prescribed rate of 100°F/hour.

Also, the long conveyor stopped working (gear box seized up) and we had some scaffolding installed to the inclined conveyor so that the kiln could continue to be fed manually.

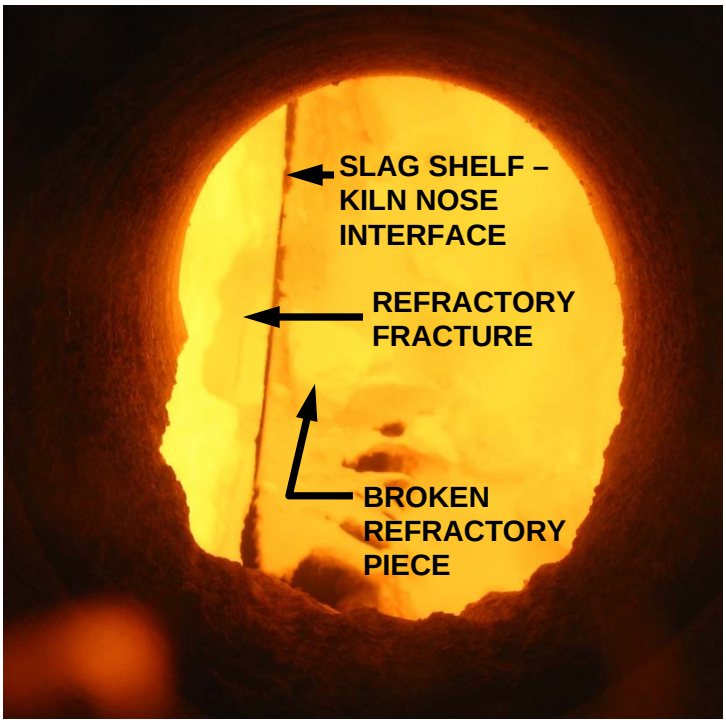


Figure B-10. Discharge Occluded by Solidified Slag

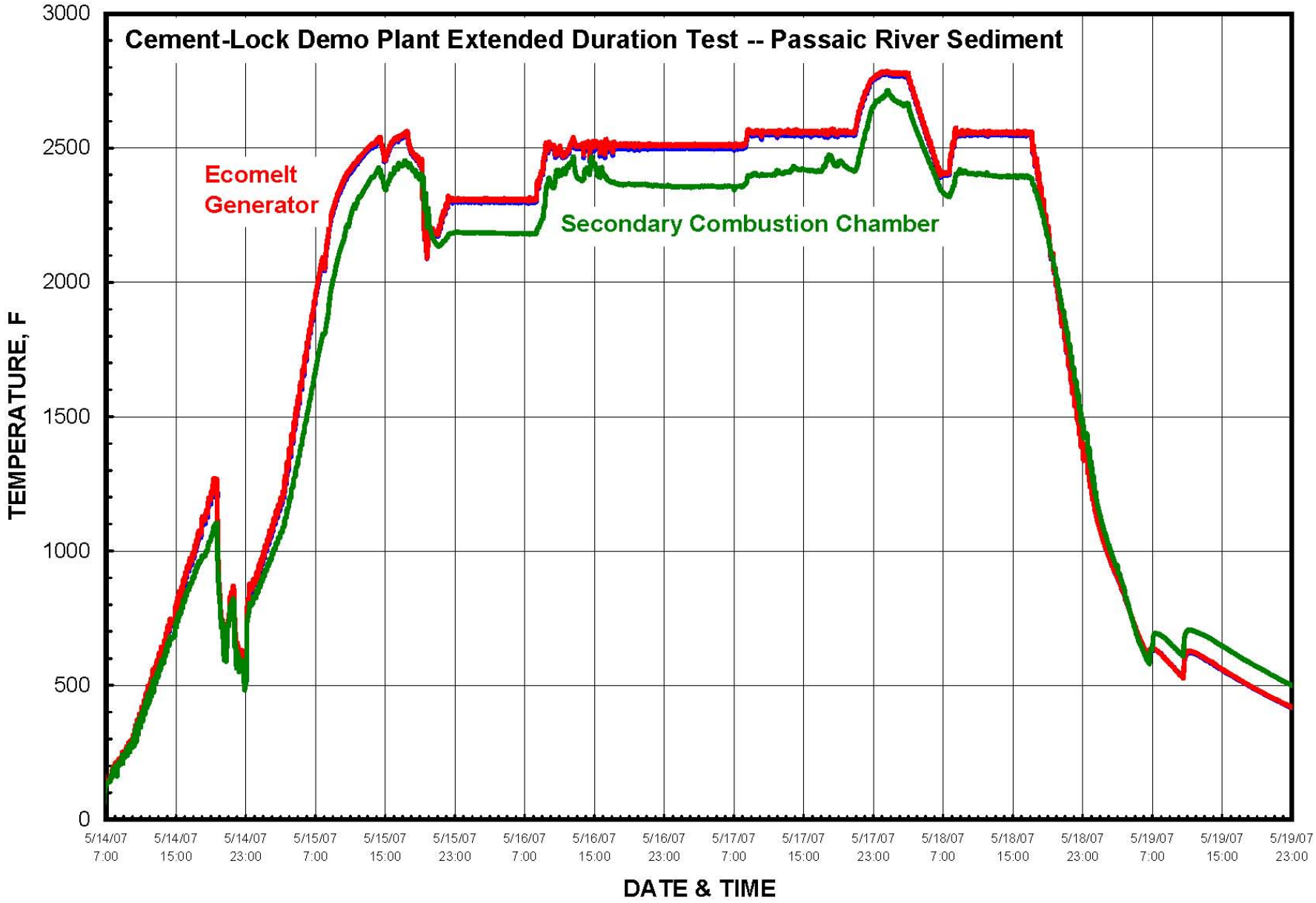
The temperature of the Ecomelt Generator ranged from 2400° to 2775°F and the temperature of the Secondary Combustion Chamber ranged from 2220° to 2700°F. The major operating conditions of the Extended Duration Test are summarized in Table B-7. The time-temperature history of the Extended Duration Test with Passaic River sediment-modifier mixture is presented in Figure B-11. Natural gas consumption averaged 18 million Btu per hour with a maximum of 23.0 million Btu per hour. When the system was "idling" overnight (no feeding) at 2300°F, the natural gas consumption was about 14 million Btu per hour.

About 15.1 tons of sediment-modifier mixture were fed to the system, which yielded an estimated 11.3 tons of Ecomelt. The natural gas consumption recorded during the Confirmation Test is presented in Figure B-12. As in previous figures, the Ecomelt Generator temperature is x10 to facilitate comparison.

The quantities of sediment-modifier mixture fed to the system during the Extended Duration Test Campaign Test are included in Table B-7.

Table B-6. Summary of Operating Conditions for Cement-Lock Demo Plant Extended Duration Test (May 14 – 19, 2007)

Test No.	**9**
Test Dates	5/14/07 – 5/19/07
Ecomelt Generator (rotary kiln)	
Temperature, °F	2300 – 2775
Pressure, inches (water gauge)	-0.2
Kiln Speed, rpm	0.25 – 0.3
Solids Residence Time, min.	129 – 107
Secondary Combustion Chamber	
SCC Burner	Low fire
Temperature, °F	2175 – 2700
Process Temperatures, °F	
Granulator	195
Quencher Outlet, average (min – max)	300 (230 – 380)
Bag House Outlet, average (min – max)	275 (250 – 330)
Activated Carbon Bed Outlet, average (min – max)	260 (220 – 290)
Stack Gas, average (min – max)	275 (240 – 315)


Cement-Lock Demo Plant Extended Duration Test -- Passaic River Sediment
Ecomelt Generator
Secondary Combustion Chamber
TEMPERATURE, F
3000
2500
2000
1500
1000
500
0
5/14/07 7:00
5/14/07 15:00
5/14/07 23:00
5/15/07 7:00
5/15/07 15:00
5/15/07 23:00
5/16/07 7:00
5/16/07 15:00
5/16/07 23:00
5/17/07 7:00
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5/17/07 23:00
5/18/07 7:00
5/18/07 15:00
5/18/07 23:00
5/19/07 7:00
5/19/07 15:00
5/19/07 23:00
DATE & TIME

Figure B-11. Time-Temperature History of the Extended Duration Test with Sediment Dredged from the Passaic River (sediment-modifier mixture)

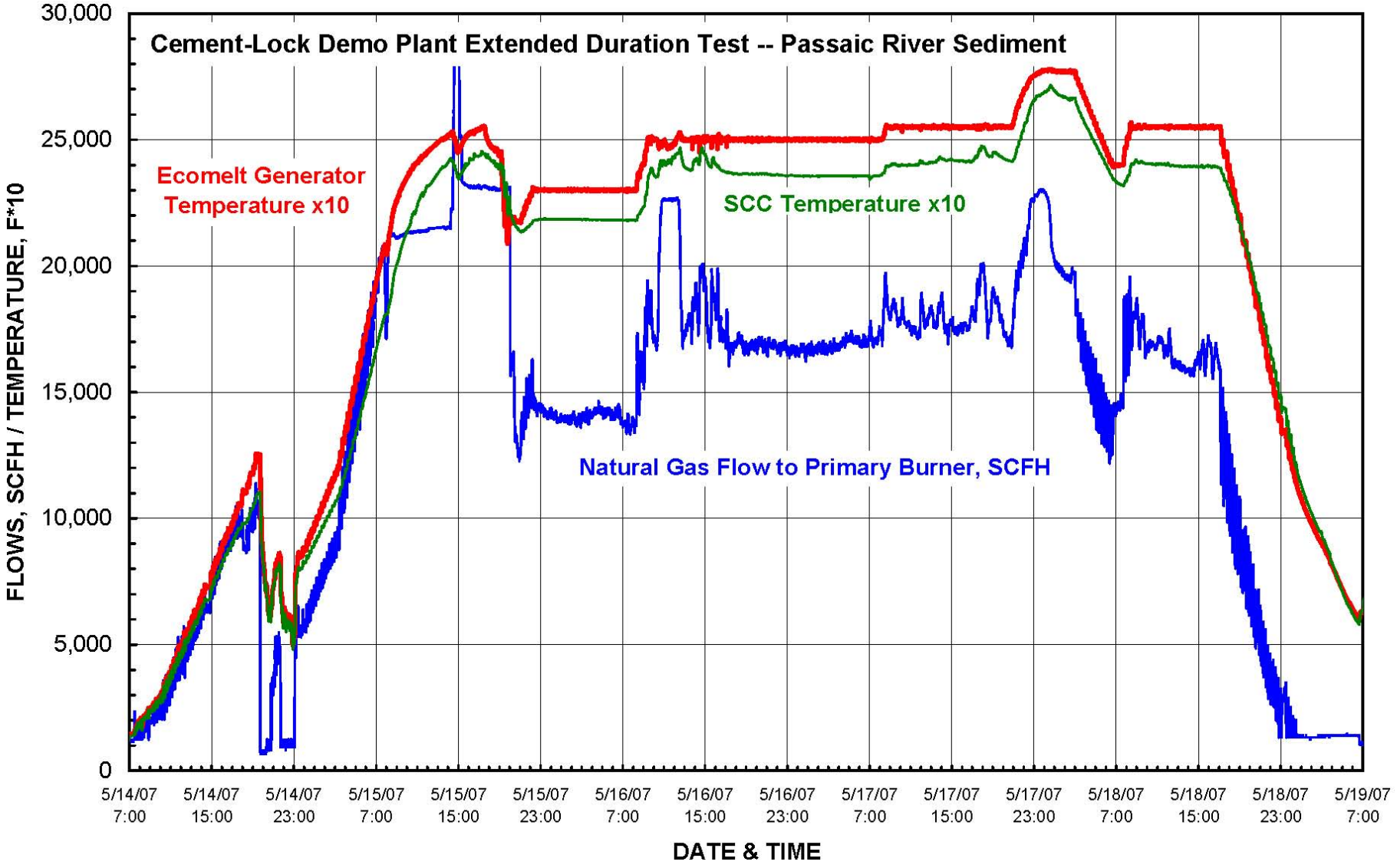

Figure B-12. Natural Gas Consumption During the Extended Duration Test (December 4– December 11, 2006)

Table B-7. Chronology of Sediment-Modifier Mixture Feeding Episodes During Extended Duration Test (May 14 – 19, 2007)

PASSAIC RIVER SEDIMENT-MODIFIER MIXTURE									CUMULATIVE		
			----- Feeding Time -----		---------- Weights, lb ----------				Sediment-Modifier Fed		DAILY
Batch No.	Day	Date	Start	End	Gross	Tare	Net	lb/hr	pounds	tons	tons
1	Tuesday	5/15/07	5:22 PM	5:55 PM	10,052	9,006	1,046	1,902	1,046	0.52	
2		5/15/07	5:58 PM	6:16 PM	9,888	9,020	868	2,893	1,914	0.96	
3		5/15/07	6:20 PM	6:28 PM	9,604	9,064	540	4,050	2,454	1.23	
4		5/15/07	6:32 PM	6:50 PM	10,098	9,046	1,052	3,507	3,506	1.75	1.75
5	Wednesday	5/16/07	9:55 AM	10:44 AM	10,416	9,176	1,240	1,518	4,746	2.37	
6		5/16/07	10:48 AM	11:38 AM	10,486	9,194	1,292	1,550	6,038	3.02	
7		5/16/07	11:42 AM	1:15 PM	10,264	9,176	1,088	1,518	7,126	3.56	Stop 12:00 pm/start 12:50 pm
8		5/16/07	1:23 PM	2:00 PM	10,506	9,208	1,298	2,105	8,424	4.21	
9		5/16/07	2:10 PM	2:38 PM	10,216	9,140	1,076	2,306	9,500	4.75	
10		5/16/07	3:12 PM	3:42 PM	10,132	9,154	978	1,956	10,478	5.24	
11		5/16/07	3:52 PM	4:08 PM	10,350	9,136	1,214	4,553	11,692	5.85	4.09
12	Thursday	5/17/07	7:59 AM	8:39 AM	9,046	7,676	1,370	2,055	13,062	6.53	
13		5/17/07	8:44 AM	9:16 AM	9,866	8,130	1,736	3,255	14,798	7.40	9:16 Conveyor shut off
14		5/17/07	3:25 PM	4:05 PM	8,552	7,908	644	966	15,442	7.72	
15		5/17/07	4:15 PM	4:45 PM	8,776	7,382	1,394	2,788	16,836	8.42	
16		5/17/07	5:00 PM	5:30 PM	8,976	7,796	1,180	2,360	18,016	9.01	
17		5/17/07	5:40 PM	6:05 PM	8,990	7,910	1,080	2,592	19,096	9.55	
18		5/17/07	6:20 PM	6:52 PM	9,194	7,898	1,296	2,430	20,392	10.20	4.35
19	Friday	5/18/07	7:35 AM	8:10 AM	8,446	7,996	450	771	20,842	10.42	
20		5/18/07	8:20 AM	8:55 AM	9,426	7,848	1,578	2,705	22,420	11.21	
21		5/18/07	9:10 AM	9:40 AM	9,002	7,936	1,066	2,132	23,486	11.74	
22		5/18/07	9:57 AM	10:35 AM	8,642	7,956	686	1,083	24,172	12.09	
23		5/18/07	10:43 AM	11:25 AM	8,832	7,362	1,470	2,100	25,642	12.82	
24		5/18/07	11:30 AM	12:00 PM	8,660	7,880	780	1,560	26,422	13.21	
25		5/18/07	1:30 PM	2:40 PM	8,686	7,760	926	794	27,348	13.67	
26		5/18/07	2:53 PM	3:23 PM	8,574	7,640	934	1,868	28,282	14.14	
27		5/18/07	3:30 PM	4:00 PM	8,820	7,940	880	1,760	29,162	14.58	
28		5/18/07	4:10 PM	4:50 PM	8,868	7,840	1,028	1,542	30,190	15.10	4.90
			Average Sediment Feed Rate		1,929.1 lb/hr		0.757 ton/hr				Total tons
			Average Ecomelt Rate		1,258.3 lb/hr		0.629 ton/hr				15.10